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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
101621,712	07/11/2003	Qi Wang	NREL 02-34	1540
23712	7590	1012012006	EXAMINER	
PAUL J WHITE, SENIOR COUNSEL NATIONAL RENEWABLE ENERGY LABORATORY (NREL) 1617 COLE BOULEVARD GOLDEN, CO 80401-3393			CHYKA, ALEXANDER G	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 10/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	101621,712	WANG, QI	
	Examiner	Art Unit	
	Alexander G. Ghyska	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE **3 MONTH(S)** OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1 Responsive to communication(s) filed on RCE of 8/7/2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11,453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 12-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11, 20-22 and 24-26 is/are rejected.
- 7) ☒ Claim(s) 23 and 27 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

ALEXANDER GHYKA
PRIMARY EXAMINER

Av 2812
Alex Ghyska

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892). | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

The Applicants' RCE of August 7, 2006 has been considered and entered in the record. Claims 1-11 and 20-27 are now under consideration. Applicants' arguments with respect to Claims 1-11, 20-22 and 24-26 have been considered, but they are not persuasive for the reasons as discussed below. Claims 23 and 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-11, 20-22 and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumura et al (US 200210189545) in view of Bu et al (US 6,806,149).

The present Claims generally require heating a substrate to be subjected to film formation, heating a wire to a wire temperature, supplying silane, ammonia and hydrogen, and forming a conformal silicon nitride film on the substrate, wherein excess hydrogen or process gas is supplied in an amount sufficient to form a substantially 100 % conformal silicon nitride film on the substrate.

Matsumura disclose heating a substrate to be subjected to film formation, heating a wire to a wire temperature, supplying silane, ammonia and hydrogen, and forming a silicon nitride film as required by present Claims 1, 5, 6, 7 and 8. See page 2, paragraphs 19- 20; page 9, paragraph 112 and page 10, paragraphs 124-126. Matsumura further discloses a substrate temperature of 200 degrees Celcius and a wire temperature of 2000 degrees Celcius as required by present Claims 2, 3, and 9-10. See page 2, paragraph 20. Matsumura discloses providing an excess of hydrogen gas, although for the benefit of preventing the deterioration of the heating element. See paragraph 129, page 10.

Matsumura et al differs from the presently claimed invention in that it does not disclose the formation of a conformal nitride layer, wherein excess hydrogen or process gas is supplied in an amount sufficient to form a substantially 100 % conformal silicon nitride film on the substrate.

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Bu et al disclose a CVD process which uses silane, ammonia and hydrogen to form conformal silicon nitride layers. See Figures 2A – 2D, column 3, lines 5-10 and column 3, line 65 to column 4, line 30.

It would have been obvious for one of ordinary skill at the time of the invention, to use the process of Matsumura et al to form a conformal silicon nitride layer as disclosed by Bu et al, as both processes pertain to CVD processes which form silicon nitride and use hydrogen, ammonia and silane as reactants. As Bu et al disclose that CVD processes using the afore mentioned reactants are known in the art, the use of a known process, CVD using hydrogen, silane and ammonia as reactants, to form a known product, a conformal CVD layer, is *prima facie* obvious. Moreover, the excess hydrogen of Matsumura combined with the disclosure of Bu et al that it is known to form conformal nitride layers, would make it *prima facie* obvious for one of ordinary skill in the art to arrive at the present limitations, as the recitation of an additional advantage associated with doing what the prior art suggests does not lend patentability to an otherwise unpatentable invention. See *In re Linfner* 173 USPQ 560 (CCPA 1972) and *In re Dillon*, 16 USPQ 2d 1897 (Fed. Cir. 1990).

Claims 4 and 11 further require pressures of 10-50 millitorr.

Matsumura et al is relied upon as discussed above, and disclose pressures of about 0.1 PA to 100 Pa.

It would have been obvious for one of ordinary skill in the art, at the time of the invention, to arrive at the presently claimed pressures as the discovery of an optimum

art. See *In re Aller*, 105 USPQ 233 (1955) and *In re Antonie*, 195 USPQ 6 (CCPA 1977). In this case the pressure would be considered a result effective variable by one of ordinary skill in the art, and the selection of the optimum parameters would be within the level of skill of one of ordinary skill in the art as simply a matter of optimization.

Claims 20-22 and 24-26 further require the conformal layer to have uniform thickness and exhibit a highly uniform thickness.

The figures of Bu et al show uniform thickness and highly uniform thickness. Figures 2A-2D of Bu et al.

It would have been obvious to one of ordinary skill in the art, at the time of the invention, to arrive at the presently claimed thickness and uniform thickness as the discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art. See *In re Aller*, 105 USPQ 233 (1955) and *In re Antonie*, 195 USPQ 6 (CCPA 1977). In this case the uniformity of the thickness and percentage of conformity would be considered result effective variables by one of

ordinary skill in the art, and the selection of the optimum parameters would be within the level of skill of one of ordinary skill in the art as simply a matter of optimization.

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Matsumura discloses supplying only sufficient hydrogen to prevent the deterioration of the heating element. With respect to the Bu reference Applicants argue that Bu fails to disclose the use of excess hydrogen to achieve this. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). It is the Examiner's position that the excess hydrogen of Matsumura combined with the disclosure of Bu et al that it is known to form conformal nitride layers, would make it *prima facie* obvious for one of ordinary skill in the art to arrive at the present limitations, as the recitation of an additional advantage associated with doing what the prior art suggests does not lend patentability to an otherwise unpatentable invention. See *In re Lintner* 173 USPQ 560 (CCPA 1972) and *In re Dillon*, 16 USPQ 2d 1897 (Fed. Cir. 1990). With respect to the Applicants' arguments that more hydrogen is necessary to form conformal silicon nitride than what is used by Matsumara to prevent deterioration of the heating element, there is no evidence of record in support. Applicants' have submitted a scientific paper by Matsumura which shows 20-30% step coverage of a similar process for forming silicon nitride. The Claims which pertain to step coverage are objected to, but would be allowable if rewritten in independent form.

Allowable Subject Matter

Claims 23 and 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The cited prior art does not anticipate or make obvious, inter *alia*, wherein the conformal silicon nitride film has a highly uniform thickness providing about 100 % step coverage as required by the afore mentioned Claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alexander G. Ghyka whose telephone number is (571) 272-1669. The examiner can normally be reached on Monday through Friday during general business hours.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AGG

October 10, 2006

ALEXANDER GHYKA
PRIMARY EXAMINER

Art 2812
Alex Ghyska

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CONCLUSIONS

Approved by the Board of Directors on 10/25/2019. On 10/25/2019

U.S. DEPARTMENT OF THE ARMY, OFFICE OF THE ASSISTANT CHIEF OF STAFF FOR LOGISTICS

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SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	10/021,712
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Filing Date	07/20/2017
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First Named Inventor	OR WANG
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2015	2016
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Examiner Name	Alexander G. Chetka
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Library Control Number	10001 10 02 74
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State	Year	Age
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Author Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, census, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
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